

Express Mail No. EL418983019US

PATENT APPLICATION OF  
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A SYSTEM AND METHOD FOR MONITORING PRINT  
CONSUMABLES OF A PRINTING DEVICE

09488091-011800

Docket No. P31.12-0009

## A SYSTEM AND METHOD FOR MONITORING PRINT CONSUMABLES OF A PRINTING DEVICE

### BACKGROUND

5           The present invention relates to a system  
and method for monitoring print consumables of a  
printing device. More particularly, the present  
invention relates to a system and method for  
monitoring print consumables of a compact disc  
10 printing device.

          A typical CD printing system includes a  
general purpose computer connected to a peripheral  
compact disc (CD) printing device. A software  
application running on the computer provides a print  
15 job, consisting of an image file and a copy number,  
to the CD printing device. The image file contains  
data on an image that is to be rendered by the CD  
printing device and the copy number indicates how  
many copies of the image file are to be rendered or  
20 the number of CD's the CD printing device is to  
render the image on. The CD printing device utilizes  
at least one print consumable to render an image onto  
a surface of a CD in accordance with the print job.  
Typical print consumables include, ink (e.g., inkjet  
25 based printing), toner (laser based printing),  
colored dye ribbons (dye sublimation based printing),  
and wax based ribbons (waxed thermal transfer based  
printing).

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The process of rendering a print job of a CD printing system, once started, is generally automated by the CD printing device. After the image file is rendered onto one CD, another CD is loaded into the printing device for printing, and repeated until all of the copies of the print job are rendered. Since the copy number of typical CD print jobs is quite large, it is common for the CD printing device to be left unattended for long periods of time. As a result, it is possible that the print consumable that is available to the CD printing device can become unexpectedly exhausted during the rendering of a print job unbeknownst to the operator, until he or she returns to check on the CD printing device. This can result in higher production costs due to a reduction in efficiency and the loss of the CD's on which the image could not be properly rendered due to the lack of print consumable. Additionally, in an attempt to avoid this problem, it is common for print consumables to be replaced prematurely to ensure that an adequate amount of print consumable is available to the CD printing device to completely render a print job. The discarding of the prematurely further increases production costs.

In the current state of the art of computerized printing devices, use and remaining levels of print consumables are determined as each print job is rendered. The quantity of print

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FIG. 1 shows a flowchart illustrating a method used by the prior art to monitor print consumable usage of a computerized printing device.

FIG. 2 shows a simplified block diagram of a compact disc printing system in accordance with an embodiment of the invention.

FIG. 3 shows a perspective drawing of a compact disc printing device with parts broken away.

FIG. 4 shows a flowchart of a method used to monitor print consumable usage of a compact disc printing device in accordance with one embodiment of the invention.

FIG. 5 shows a flowchart of a method used to render a print job in accordance with one embodiment of the invention.

FIG. 6 shows a flowchart of a method used to interrupt a print job in accordance with one embodiment of the invention.

FIG. 7 shows a flowchart of a method used to render a batch print job in accordance with one embodiment of the invention.

#### DETAILED DESCRIPTION

A compact disc (CD) printing system utilizing aspects of the present invention, generally designated as 20, is shown in FIG. 2. The system includes a general purpose computer 22 having a memory 24 and an input/output (I/O) port 26, a software application 28 configured to run on computer

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22, a print consumables monitoring (PCM) module 30,  
and a peripheral CD printing device 32. Software  
application 28 is configured to produce a print job,  
expressed in a language that can be understood by CD  
5 printing device 32, and communicate the print job to  
CD printing device 32 through I/O port 26. One  
embodiment of the print job includes at least one  
image file and a copy number. The image file  
generally contains data of an image, text, or both,  
10 that is to be rendered onto a CD by CD printing  
device 32. The copy number indicates the number of  
copies of the image file that are to be rendered or  
the number of CD's the image is to be rendered on.  
The present invention is equally applicable to  
15 monitoring print consumables used to render print  
jobs onto digital video discs, recordable CD's, CD-  
ROM's, and other CD-like media. To simplify the  
discussion of the invention, references to a CD are  
intended to include all forms of CD-like media.

20 CD printing device 32 is electronically  
coupled to computer 22 at I/O port 26. CD printing  
device 32 utilizes at least one print consumable to  
render an image file onto a CD. Examples of print  
consumables include, ink (e.g., inkjet based  
25 printing), toner (laser based printing), colored dye  
ribbons (dye sublimation based printing), and waxed  
based ribbons (wax thermal transfer base printing).  
CD printing devices 32 can be adapted to  
automatically load and unload CD's in order to

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process a large number of CDs without the aid of an operator. As a result, CD printing device 32 can be left unattended during the rendering of a print job that includes a large copy number. An example of a  
5 suitable CD printing device 32 is the Signature II™ CD color printer manufactured by Primera Technology, Inc. of Plymouth, Minnesota, and described in U.S. Patent 5,927,208, which is incorporated herein by reference.

10 In one embodiment of the invention, CD printing device 32 is an inkjet printer such as that shown in FIG. 3. CD printing device 32 generally includes a housing 34, a tray 36, CD loading and positioning machinery 38, a print head 40. A tray 36  
15 is configured to hold a CD 42 having a surface 44 upon which an image is to be rendered. Tray 36 is shown in its extended position where a CD 42 can be placed onto tray 36. Tray 36 also has a printing position where tray 36 is slid into housing 34 such  
20 that a CD 42 on tray 36 is positioned for printing beneath print head 40. Tray 36 is moved between the extended position and the printing position using CD loading and positioning machinery 38. Print head 40, shown as a conventional inkjet print head containing  
25 an ink print consumable, is used to render an image onto a CD 42 in accordance with a print job. Print head 40 is mounted on a lateral slide rod 46. Movement of print head 40 is controlled by belt 48 that is mounted on suitable pulleys 50 and is driven

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by a stepper motor 52. The CD printing device 32 shown in FIG. 3 can be adapted to automatically load and unload CD's 42 onto tray 36 such that a large number of CD's 42 can be loaded for printing without  
5 the aid of an operator.

PCM module 30 runs on computer 22 and communicates with memory 24 and software application 28. PCM module 30 is configured to maintain a remaining print consumable amount in memory 24. The  
10 remaining print consumable amount relates to the amount of print consumable that is currently available to or loaded in CD printing device 32. PCM module 30 can periodically update the remaining print consumable amount in memory 24 by subtracting the  
15 amount of print consumable used by CD printing device 32 to render an image. PCM module 30 is further configured to communicate with software application 28 and inform software application 28 when the remaining amount of print consumable that is  
20 available to or loaded in CD printing device 32 is insufficient to completely render the current print job. When PCM module 30 notifies software application 28 that the remaining amount of print consumable is insufficient to process the print job,  
25 software application 28 can interrupt the rendering of the print job.

In another embodiment of the invention (not shown), CD printing device 22 includes a processor and a memory. This "smart" printing device includes

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amount is compared to the remaining print consumable amount at step 60. If the requested print consumable amount does not exceed the remaining print consumable amount, software application 28 sends the print job to CD printing device 32 to render the print job at step 62. After all of the copies of the image file of the print job have been rendered, the rendering of the print job is completed as indicated at step 64. If the requested print consumable amount exceeds the remaining print consumable amount, then the rendering of the print job is interrupted at step 66 by software application 28 and the print job is not sent to CD printing device 32 for rendering.

FIG. 5 shows one embodiment of the rendering step 62 where the remaining print consumable amount is updated after each copy of the image file of the print job is rendered by CD printing device 32. In this embodiment, software application 28 instructs CD printing device 32 to render a single copy of the image file at step 68. At step 70, the remaining print consumable amount is updated by PCM module 30 by subtracting the amount of print consumable needed to render the single copy of the image file or a single print consumable amount from the remaining print consumable amount. At step 72, software application 28 determines whether all of the copies of the print job have been rendered. If more copies are to be rendered, the method returns to step 68 where another copy of the image file is

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rendered by CD printing device 32 and the remaining print consumable amount is updated by PCM module 30 at step 70. If all the copies have been rendered, the print job is completed as indicated by step 74.

5 In one embodiment of the interrupting step 66, software application 28 warns the user that the print job cannot be completely rendered. Alternatively, PCM module 30 can be configured to provide the warning to the user. The warning may  
10 consist of an alarm and a text message which indicates that the remaining print consumable amount is insufficient to completely render the print job.

One embodiment of the print job includes a print quality setting relating to the amount of print consumable used to print the image of the image file,  
15 thus affecting the requested print consumable amount for the print job. One embodiment of interrupting step 66 includes providing the user with an option of adjusting the print quality setting of the print job.  
20 By appropriately adjusting the print quality setting of the print job, the requested print consumable amount can be reduced such that it does not exceed the remaining print consumable amount.

FIG. 6 shows yet another embodiment of the  
25 interrupting step 66 in which either software application 28 or PCM module 30 provides the user with at least one of the options listed in step 76. The options include: A. adjusting the current copy number X to a smaller copy number Y; B. adjusting the

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If option A. is selected, the method moves to step 80 where the user is prompted to enter a new copy number for the print job. At step 82, a requested print consumable amount is determined by PCM module 30 based upon the new copy number and the single print consumable amount as in step 56 of FIG. 4. Finally, the method returns to step 60 of the flowchart of FIG. 4 where the general method continues as previously discussed.

20           If the user selects option B., the user is  
prompted to replace the print consumable currently  
loaded in CD printing device 32, as indicated at step  
84. In one embodiment of step 84, the user is first  
prompted to provide a filename for the print  
25 consumable that is to be replaced. Once entered, PCM  
module 30 stores the remaining print consumable  
amount of the print consumable in memory 24 under the  
filename provided by the user for later retrieval by  
the user. Next, the user is prompted to replace the

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application 28 instructs CD printing device 32 to render the print job as previously discussed. If the user selects option D at step 78, the method moves to step 64 and a print job is not rendered by CD printing device 32.

Another embodiment of the print job is a batch print job. The batch print job includes multiple image files, each of which are to be rendered by a printing device. A copy number for the batch print job can be used to indicate the total number of copies of the image files in the batch print job that are to be rendered by the printing device. Additionally, the batch print job can include a print quality setting relating to the amount of print consumable used to render the image files, thus affecting the requested print consumable amount for the print job. One example of a batch print job includes image files that are to be rendered onto a CD using, for example, CD printing device 32. Although the various embodiments of the invention relating to the batch print job described below are directed toward monitoring print consumables of CD printing device 32, the described embodiments are equally applicable to printing devices that are adapted to render other varieties of batch print jobs. For example, the present invention can be used to monitor print consumables of a printing device that is adapted to render a batch

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print job consisting of image files of addresses which are to be rendered on labels or envelopes.

The method used to monitor the rendering of a batch print job generally follows the method illustrated in FIG. 4. A print job, in the form of the batch print job, is received at step 54. A requested print consumable amount is estimated by PCM module 30 at the step of 56. This is accomplished by selecting one of the image files that is to be printed first and determining a single print consumable amount for the image file, defined as an amount to print consumable needed by the printing device, such as CD printing device 32, to render the selected image file. The single print consumable amount is then multiplied by the number of image files that are to be rendered to estimate the requested print consumable amount for the batch job. This generally results in a reasonable estimation of the amount of print consumable needed to render the batch print job since the single print consumable amounts for the image files are relatively equal.

At step 58, the remaining print consumable amount that is available to or loaded in the printing device is obtained from memory 24 by PCM module 30. At step 60, the requested print consumable amount is compared to the remaining print consumable amount. If the requested print consumable amount exceeds the remaining print consumable amount, the rendering of

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the print job is interrupted at step 66, as previously discussed.

In one embodiment of the invention, software application 28 instructs the printing device to render each of the image files of the batch print job when the requested print consumable amount does not exceed the requested print consumable amount, as indicated at step 62. Once each of the image files are rendered in accordance with the batch print job, the print job is completed as indicated at step 64.

In another embodiment of the invention, step 62 of FIG. 4 is implemented using the flowchart of FIG. 7 beginning with step 96. At step 96, software application 28 instructs CD printing device 32 to render the first or selected image file. At step 98, the remaining print consumable amount is updated by PCM module 30 by subtracting the single print consumable amount for the selected image file. At step 100, PCM module 30 determines whether the remaining print consumable has been unexpectedly exhausted. Step 100 of FIG. 7 exists due to the assumption that each of the image files in the batch print job have similar single print consumable amounts and that the requested print consumable amount is estimated based upon the single print consumable amount of one of the image files. Consequently, it is possible for PCM module 30 to underestimate the amount of print consumable needed to render the batch print job. Thus, the purpose of

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step 100 is to interrupt the rendering of additional image files when the remaining print consumable becomes unexpectedly exhausted. If the remaining print consumables have not been exhausted, the method  
5 moves to step 102 where software application 28 determines whether all of the image files of the batch print job have been rendered. If all of the image files have been rendered, the method returns to step 64 of FIG. 4 and the processing of the batch  
10 print job is competed. If there are still image files to be rendered at step 102, then the next image file is rendered by CD printing device 32 at step 96 and the remaining print consumable amount is updated at step 98 by subtracting the single print consumable  
15 amount for the image file just rendered. In this manner, the amount of print consumable that is available to CD printing device 32 is accurately maintained by PCM module 30. Steps 96 and 98 will repeat unless the remaining print consumables have  
20 been unexpectedly exhausted (checked at step 100) or all of the image files of the batch print job have been rendered (checked at step 102).

If, at step 100, PCM module 30 determines that the remaining print consumables have been  
25 exhausted, software application 28 interrupts the rendering of the print job at step 104. In one embodiment of step 104, a warning is provided to the user indicating that the print consumables of CD printing device 32 have been exhausted. Another

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embodiment of step 104 includes providing the user with an option of adjusting the print quality setting of the batch print job. By reducing the print quality setting it is possible to reduce the requested print consumable amount such that it does not exceed the remaining print consumable amount.

In yet another embodiment of step 104, the user is provided with at least one of the options shown in step 106 of FIG. 7. The options can include an option to: A. adjust the amount of remaining print consumable; B. ignore the interruption and continue rendering the batch print job; and C. cancel the rendering of the batch print job. Each of these listed options constitutes an individual embodiment of the invention. Additional embodiments involve providing the user with some or all of the options listed in step 106 including the option to reduce the print quality setting of the print job mentioned above.

If the user selects option A., step 108 directs the method to step 110 where the remaining print consumable amount can be adjusted by the user. Prior to replacing the print consumable, the user can be asked to provide a filename for the print consumable that is to be replaced. The remaining print consumable amount relating to the print consumable that is being replaced is stored in memory 24 by PCM module 30 under the given filename. The user may then either insert a new print consumable or

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a previously used print consumable and the remaining print consumable amount for CD printing device 32 is updated or reset by PCM module 30 to reflect the new amount of print consumable as previously discussed.

5 The method then continues from step 60 of FIG. 4. If option B. is selected, step 108 directs the method to step 102 where the process of rendering the image files of the batch print job continues as discussed above. In one embodiment of the invention, the  
10 interrupting step 104 and the step 100 where it is determined whether the remaining print consumable has been exhausted, can each be disabled when option B. is selected. Finally, if option C. is chosen, the method returns to step 64 where the processing of the  
15 batch print job terminated.

The described invention provides a method for monitoring print consumables of a printing device and determining whether there is a sufficient amount of print consumable loaded in the printing device to  
20 completely render a print job. The print job is rendered by the printing device if a sufficient amount of print consumable is loaded in the printing device. The print job is interrupted if there is not a sufficient amount of print consumable loaded in the  
25 printing device to completely render the print job. By using the present invention, the need to prematurely replace print consumables of the printing device can be avoided and large print jobs can be rendered without worrying about whether there is a

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Although the present invention has been described with reference to preferred embodiments, workers skilled in the art will recognize that changes may be made in form and detail without departing from the spirit and scope of the invention.